RESPONSE TO CLAIM REJECTIONS – General

By the above amendment, applicant has replaced claims 1 through 41 with claims 42 through 92, the new claims being specifically written to define the invention more particularly and distinctly so as to overcome the technical rejections raised by the Final Office Action (OA hereinafter) and to define the invention patentably over the prior art.

Claims Rejections Under 35 USC §101

The OA rejected claims 25, 26, and 27 as directed to non-statutory subject matter. In Ex Parte Carl A. Lundgren (heard 04/20/04) the Board of Patent Appeals determined *per curiam* that an §101 objection not grounded on the limited and specifically listed bases for exclusion found in Diamond v. Diehr, 450 U.S. 175, 185; 209 USPQ 1, 7 (1981) – those specifically listed bases being "laws of nature, physical phenomena and abstract ideas" – must fail.

A computer implemented method that does not interact with humans in some manner (however indirect) is a priori unusable and so can have no result, tangible or otherwise. The purpose of a tangible result is clearly for the benefit of human beings. Applicant does not understand how a computer implemented method incorporating interaction with, presentation to, or input from a human user can, therefore, be non-statutory subject matter if interaction, presentation, or input are already acceptable steps. Many inventions are specifically methods improving human interaction and it is unclear how such methods can be adequately claimed without reference to that human interaction. Indeed, OA's own citations include such claims (see, for example, the following claims – Afeyan: 27, 31, 35, 42, 50, 51, 58, 59, 60, 61, 65, 77, 82, 83, 85, 86, 87, 88, 89, 90, 91, 92, 93, 95, 97, 99, 101, 117; Altschuler: 12, 13, 15, 17, 19, 21, 35, 36, 38, 40, 42, 44; Cha: 1, 2, 3, 5, 7, 8, 9, 11, 12; Cheng: 27, 29, 32, 33, 39, 40, 46, 47; Georgalas: 5, 6; Lin: 10, 32; Pham: 17; Shteyn: 11; Silverberg: 1, 4, 5, 8, 9, 10, 11, 12, 13, 15, 16. Applicant respectfully requests guidance from Examiner as to how such clams are to be judged statutory or non-statutory. Nonetheless, as these claims have been withdrawn, and as the new claims 85 and 86 are specifically directed to a computer-implemented method as required, these

grounds for rejection have been traversed.

If Examiner again rejects the new claims 85 or 86 on the same grounds, Applicant respectfully requests Examiner's aid in rewriting at least one of these rejected claims, as neither Applicant is either a patent attorney or a patent agent and Examiner's rejection appears to be a technicality based on wording. The rejected claims 25 (defining a heuristic rule), 26 (modifying a heuristic rule), or 26 (specifying a criterion of applicability of the first heuristic rule) which Examiner has rejected each require accepting input from a human user and such input is a key element of the respective method being claimed.

Claims Rejections Under 35 USC §103

Erroneous Assumptions as Basis for Rejections

OA erroneously asserted a number of equivalences between the prior art and Applicant's invention. Some assertions directly contradict Applicants' specification and claims. Others represent an understanding completely foreign to one of ordinary skill in the relevant arts.

To assist non-specialists in the field of data integration, data transformation, and semantic modeling, and to avoid application of the erroneous assertions, the relevant rejected claims have been rewritten to more clearly convey inherent differences from the prior art, which would have been considered inherent in the original language by specialists in the cited fields.

References Cited in the OA and Differences Of The Present Invention Thereover

Prior to discussing the replaced claims, Applicant will address the references cited in the OA and show both the novelty and unobviousness of the present invention over each reference.

Overview of Georgalas

Georgalas lies in the field of object-oriented, distributed computing. It teaches and discloses a software implementation of an object oriented method for identifying and creating new resources (Abstract, para 0080-0127). The disclosed architecture enables extension to new types of resources only by adding additional mediators and resources, a task requiring programming. Each of Georgalas' embodiments *<u>require</u>* adding a specification, generating a wrapper, and providing at least one mediator associated with each resource (Fig. 1 and 2) using, per the only example provided, the Method of Object Primitives (MOP) as a common resource representation language. The wrappers and mediators serve to convert each resource into a common resource representation (Abstract and para 0035-38). The Primitives consist of Constraints, Relationships,

Classes, and Policies. Classes are subtyped as one of Collection Class, State Class, or Behavior Class. Georgalas provides examples of the semantic structure of various *language* standards such as XML, ODMG, and SQL, but does not provide any method of producing a semantic model for the content of any document applied to an application domain or even an example of a semantic model of any specific category of knowledge, application domain, or topic.

Georgalas' invention addresses the problem of how to combine multiple data and information systems or multiple services by treating them as resources having a representation in a common language ("a common resource representation") so that they can be combined to create the appearance of new services. Every "resource" is presumed to have a well-defined specification or representation. Georgalas gives several examples of such resource specific representations, each of which is a "meta-model of the semantics" of a language used by a resource. Georgalas provides no example of a semantic model of the content of a resource. For example, Georgalas gives the "semantic structure of XML", suggests that resources might have an XML representation, and gives an example mapping from an XML schema to MOP. However, Georgalas provides no example of how an application of the XML schema is to be used in any differentiating manner and therefore, offers no semantics for the content of a resource. Therefore, when Georgalas discloses transforming a resource representation to a common resource representation, his purpose is the mechanical and inflexible transformation between two computer languages (or specifications).

Georgalas offers no way of differentiating between elements of a resource's content other than a symbolic name because he is not concerned with this problem. He need only know how to translate (map) the resource language construct into an equivalent common representation (another language construct) as given, for example, by Table 1 (referenced at para 0133). This "mapping" clearly assumes that the specific instance of the translated construct does not pre-exist. For example and considering the example following paragraph 0147, what is to be done if "StateClass Name" already exists in the MOP common representation? Furthermore, how is one to know if, for example, an XML

element "<elementType id="Person">" as used in an XML document is equivalent to "StateClass Individual" in a MOP document. Resolving semantic conflicts and establishing semantic congruence or equivalence are serious problems when mapping and transforming documents from one semantic model to another semantic model. Georgalas does not address these problems because he is not concerned with mapping and transforming documents from one semantic model to another semantic model.

Georgalas offer only a manual method of combining resources – a user is required to assert "associations" between "common ones" of the resources once they have been given a common representation. Georgalas' invention then transforms resources into the common resource representation, which is known in advance, according to the manually defined associations. By contrast, Applicant's invention discloses methods of automatically identifying and refining mappings among elements of semantic models, thereby removing reliance on costly and error-prone manual "associations."

Georgalas is concerned with specifications of objects in a common language, not with semantic models. That specification languages or data modeling languages have semantics does not suffice to make a representation using them a semantic model. None of the references cited by Georgalas are cited for the purpose of implementing semantic models. Of all the references cited, only Myopoulos deals with semantic models and Georgalas cites this reference (para 0089) only with respect to <u>classification</u> of classes as it occurs in MOP.

The subject of Georgalas' invention is to address "issues associated with the utilization of heterogeneous resources such as information and services" (para 0004) by translating "the diversity of modeling semantics that introduces such problems when the need emerges for the integration of different information resources." (para 0005) Georgalas gives XML, SGML, CORBA, OMG, DCOM, SQL, EER, OO, and relational (i.e., SQL) (paras. 0005-0006, 0009) as examples of "modeling semantics" which he makes clear are "modeling languages" (para 0009) and which are nowhere equated to semantic models of specific categories of knowledge (as found in Applicant's invention), let alone business

documents. Methods (such as those of Georgalas) are generally understood as performing syntactic transformations among languages that have differing syntax even if (as in the case of Georgalas) they are driven from a so-called model of the languages' semantics.

Approaches such as Georgalas' invention which leave the content of all resources in place – "the resources themselves still reside on their native hosts" (para 0070) – but provide a common representation of them, are known as federated approaches. Georgalas' approach, although dealing with languages and specifications, is also a "mediator system" (para 0011) which implements the recognized prior arts of semantic mediation with the common resource representation playing a role similar to a "universal" semantic model, both described in Applicants' specification (Applicant, para 0084). Georgalas' approach (para 0035-0038) captures representations of resources (expressed in its respective representation and known via a specification – see also para 0066), transforms the respective representation into a common representation such as MOP, creates associations manually among the representations now in the common representation, and uses the combination of resource representations (now in a common resource representation) to create so-called "new resources". Georgalas teaches no method to create any of the specifications (of resource representations) on which his invention depends, preferring that they be pre-existing, publically available specifications (para 0066). Such specifications are as close as Georgalas comes to a source semantic model, and in this case, they are limited to the resource representation language.

Georgalas' invention is described (para 0035, 0037) as transforming resource representations of sets of resources into a common resource representation and "permitting" rule-based associations among the components of the common representations of the sets of resources to define a new resource. It generates wrappers using a wrapper template tool (para 0024-0034), uses – through transformation into a common resource representation (0036) – "a rule-based association among component ones [sic] in their common representation to define a new resource" (para 0037), and uses integrating mediators to define new resources. Wrappers perform transformations

between a resource representation (in which each resource has been identified) and a common representation (para 0066), transforming *__a description__* of each of the resources from their native representation into the common (para 0067) and also the reverse transformation.

Georgalas fails to discloses using either transformation rules or validation rules applied to the content of resources. Only transformation of representations (0036, 0066-68) and validation of new specifications (para 0078) are disclosed, an inherently less complex problem than that attacked by Applicants' invention since, in Georgalas, the complete specification of both the resource representation and the target common resource representation are fully known in advance and do not change. In Georgalas, a specification need be validated only once since it does not change and the content of a resource is simply assumed to be consistent with that specification. There is no semantic drift with which to contend, no concern over identifying the category of knowledge or the domain of application, etc. In the problem addressed by Applicant, each of these concerns must be considered and every instance of document should be validated. In Georgalas, it is up to the user of a "resource specification tool", the method of which is not disclosed, to specify the new resource in terms of the existing resources, generate a declarative specification of the new resource, and to generate the resource from this specification (para 0074-76).

Differences Between Applicant and Georgalas

Georgalas and Applicant address different problems (new resource creation vs. data transformation) in different fields and use different approaches (common representation, mediator systems vs. many-to-many semantic mapping). The disclosed embodiments of Georgalas and Applicant have no architectural components in common. Applicant requires none of the specific limitations found in Georgalas as described above.

Unlike Georgalas resources, Applicant' documents are not required to follow a standard language (such as XML, ODMG, or SQL) specification. Georgalas method depends on the representation type of the resource (i.e., some indication of the specification of

language it is stored in or by which it is accessible), whereas Applicants' method can *additionally* take advantage of the usage type of a document (e.g., purchase order, irrespective of the representation) and its specific content (e.g., the usage of a particular SAP-IDOC field like Item Description – para 0032) described by a category of knowledge, domain semantic model, topic semantic model, and so on, even if the representation type is not predetermined.

Georgalas requires wrappers specific to a type of resource and supports the semantics of that type of representation, but not of the semantics of the content. This is distinct from Applicants' invention, which builds semantic models of the content of document types. The format of a document and protocol for accessing its content are handled by an Adapter, which is necessarily syntactic (dealing with form and structure), but might not address semantics even at the level of a representation language. An Adapter supports a protocol and a format of a document as may be required by a source or a destination. Georgalas' wrappers encapsulate a specific resource and access it based on the semantics of the resource's representation. Georgalas fails to disclose Data Adapters and Metadata Adapters, or to teach any distinction between them as in Applicants' claims and specification.

Georgalas fails to disclose any method to create new semantic models, (Applicant discloses both semantic model templates pertaining to the category of knowledge or domains, and the creation of seed semantic models by using Metadata Adapters), any Semantic Modeler component of the architecture, or any component of the architecture accessible to a Semantic Modeler component that is capable of performing data profiling, data cleansing, *data* validation (as contrasted with specification validation), or data normalization. Georgalas fails to disclose any method for suggesting promising (i.e., candidate) model mappings.

Applicant's invention does not require a common representation of business documents and the specification explicitly denies the general appropriateness of such a "hub-based" approaches (Applicant, 0084) with their single semantic model used as a common

reference ("common representation" as in Georgalas). Georgalas explicitly embraces the "semantic mediation" approach (with its mediators, wrappers, and MOP common representation), which Applicants acknowledged as prior art in the cited paragraph. While Applicants' method does not depend on a common representation, neither is this a limitation that prevents a common representation from being used where appropriate and without loss of the many other benefits of Applicants' invention. (Applicant's method, however, would differ significantly from that of Georgalas.)

Georgalas discloses no method for detecting and correcting erroneous data values automatically, and cannot handle semantic model drift, as taught in Applicants' claims (new Claims 55, 69, 70) and specification (Applicant, para 0032-0033, 0066). If the common resource representation is not rich enough to represent an element of a resource representation, no method is disclosed by Georgalas that would extend or correct it. By contrast, Applicant discloses using the modeling, mapping, validation, and transformation architectural components for data profiling, data normalization, data cleansing, and data normalization (e.g., Applicant, para 0075).

Unlike the element-to-element translation described by Georgalas, Applicant uses (semantic) model mapping between semantic models. Semantic model mapping establishes concept-to-concept relationships, typically in a usage context (Applicant, para 0111). As is well known to those of ordinary skill in the art of semantic modeling and mapping, semantic concepts may involve many elements and the relationships among them. Applicant discloses several techniques, including the application of Equivalence Heuristics (Applicant; para 0197-0205), by which candidate model mappings can be identified and subsequently applied during transformation. It is obvious that such mappings may include substitution of corrected data values (the correct value being known by having a strong relationship with other values of the concept) for incorrect data values as required for data normalization and cleansing, either pre- or post-transformation.

Georgalas does not disclose data cleansing, data normalizing, or data profiling, while Applicants' claims and specification do (Applicant; Abtract, para 0017, 0026, 0027, 0050, 0073, 0075, 0109, 0122, 0136). Applicant discloses identifying the semantic model of a source document by, for example, validating that the source document is consistent with the semantic model associated with the source (Applicant; para 0078, 0098, 0112-0124). In light of Applicant's disclosure, it is obvious that data profiling can be accomplished by iteratively applying this operation to a set of such semantic models until a best fit by validation is identified. Furthermore, the architecture and methods disclosed by Applicant, including reapplying model mapping in response to errors detected during the validation of the transformed document for consistency with the destination semantic model (Applicant; para 0063, 0075, 0098, 0131, new Claims 55, 70, 77), can address the problem of semantic model drift. Additionally, Applicant discloses using Data Adapters to perform data cleansing and data normalization (Applicant; para 0180-0181). Georgalas does not suggest such functionality for any architectural component (including wrappers and mediators).

Georgalas fails to teach any method for implementing and modifying transformations (Applicant; para 0090-0096, 0126-142), relying on hardcoded capabilities of mediators and wrappers. Applicants' specification teaches using transformation rules and explicitly teaches against using such "full-fledged functions" hardcoded in software (Applicant, para 0034). Georgalas fails to disclose using concepts and vocabulary close to that used by business users as in Applicants' claims and specification (Applicant, para 0035), relying entirely on software engineering methods. Both separately and together these differences preclude Georgalas from leveraging the domain knowledge of business users to either develop or refine transformations, while Applicant's invention clearly has this benefit.

Applicant's invention teaches driving semantic transformation of documents from a model mapping, and deducing that model mapping (between source and destination semantic models) from, for example, Equivalence Heuristics. This insures that the process is adaptive and can become increasingly more accurate over time (Applicant;

new Claim 55, 69, 70). By contrast, Georgalas' invention teaches creating new resources from combinations and associations among the elements of existing resources, irrespective of changes to the content in those resources. The specification for the new resource determines how content from existing resources will be combined, without regard for inconsistencies that may develop between a resource's content and its specification. Georgalas' invention is, therefore, non-adaptive to change and requires regeneration if a specification changes.

Applicants' specification and claims (e.g., Applicant; para 0161) teaches using sub-methods which obviously have the properties of being at least semi-automated, incrementally, and repeatedly applicable (and so having an adaptive effect), continuously maintainable and flexible (Applicant, para 0023), and which can be used by business users. These include sub-methods for building, modifying, and using vocabularies, creating and modifying rules, model mappings, and semantic models, the combination of which also enables a synergistic result with significant benefits in reducing implementation costs and labor for business document processing and exchange. No similar teaching is found in Georgalas, let alone any prior art pertaining to data transformation driven by semantic models.

Applicants' discloses determining (at least partially) which transformation rules are to be applied by a document's content (Applicant; para 0028, 0127-133), rather than solely on its representation type as in Georgalas. This is inherent in the nature of transformation driven by source and destination semantic models, model mappings, and context (as provided by, for example, topic semantic models), as contrasted with the mechanical translation between specification or representation language constructs and elements as in Georgalas. Likewise, determining the appropriate semantic model to apply to a source document is not addressed by Georgalas, let alone making that determination in part based on a document's content (Applicant; para 0127).

Applicant's Adapters differ from Georgalas' Wrappers. Adapters encapsulate methods for connecting otherwise incompatible software components or systems, handling

incompatibilities among formats and protocols. An Adapter extracts (or packages) the content of a source (or writes to the destination) document into a form that the intended recipient can further process. (Applicant, para 0154, 0176-0185). Georgalas' wrappers, by contrast, enacapsulate a resource, while Adapters do not. Furthermore, unlike Georgalas' wrappers which are generated from a template, Applicant's Adapters are not restricted to being generated.

Applicants' invention yields many novel and unexpected benefits including, for example: the ability to map product catalogs; the ability to handle incommensurate semantics among the plethora of documents businesses must exchange; avoiding the high cost and time of building a master or universal semantic model by an incremental and modular approach to semantic models that partition the necessary knowledge in various ways (incremental deployment and maintenance); the ability to handle semantic drift incrementally in the face of changing business processes, relationships, contracts, government regulations, policies, etc.; maintaining semantic integrity, guided and automatic correction of business documents; and, using business vocabulary so that domain experts can create and maintain document transformation without excessive reliance on IT personnel. These benefits show the superiority of Applicants' invention over the prior art. Georgalas, which is the only prior art OA cites regarding Applicants' independent claims, offers none of these benefits.

Given all the above, nothing in Georgalas makes Applicant's invention, as described in the specification and PPAs, Claims 1-41, or new Claims 42-92, obvious.

Overview of Cha

Cha lies in the field of information generation and retrieval (Abstract; C1:9-23). In particular, Cha teaches a method of natural language query processing based on the sentence structure and semantics of natural language sentences. Cha teaches four aspects or methods for "generating and retrieving based on standardized formats of sentence structure and semantic structure" of the invention and two aspects on computer readable

media (C2:44-C4:33).

Cha's first method requires stored language knowledge, receiving as input a natural language query sentence in a standard format, an input sentence analyzing unit, a semantic structure processing unit, an interactive processing unit, and an information transferring unit. Cha's second method transforms a natural language sentence into an indexed conceptual graph, and then transforms a natural language query sentence into a conceptual graph and searching the indexed information for information relevant to the user requirement. Cha's third method resolves ambiguities of sentence structure and semantic structure of a natural language sentence, translates the natural language sentence into a conceptual graph using sentence analysis and semantic analysis, and transforming the conceptual graph into an indexed record in a table. Cha's fourth method transforms a natural language query sentence into a conceptual graph using sentence analysis and semantic analysis, searching a database for a nearest query and computing semantic relevance, and providing indexed information to the user.

Cha's semantic structure of a natural language sentence is merely a set of conceptual relations selected from a standard (i.e., fixed in advance) set described only once (C7:32-C8:12). Cha provides no explanation of a conceptual graph or any citation regarding it, referring merely to universities where research involving conceptual graphs is allegedly underway. Cha discloses the use of semantics (structure, representation data, analysis, relation, relevance, etc.) pertaining specifically to natual language sentences, but no general method of modeling semantics of documents or using semantics to drive transformation of documents between semantic models. Cha is limited by a single embodiment, which requires morphological analysis, a thesaurus system, and a specific formula for computing semantic relevance.

Applicants' invention requires none of the limitations of Cha, such as stored knowledge of a natural language, receiving as input a natural language query sentence in a standard format, an input sentence analyzing unit, a semantic structure processing unit, an interactive processing unit, an information transferring unit, or conceptual graph nor is

Applicant's invention limited in application to natural language generation and retrieval of information using natural language sentences. Cha solves a different problem (information generation and retrieval) in a different field (natural language processing). Cha does not use the terms such semantic model, model mapping, transformation, and the like (or their functional equivalents) which are necessary to Applicant's claims and specification.

Overview of Meltzer

Meltzer lies in the field of systems and protocols supporting transactions among networked platforms having variant architectures (C1:45-50). Meltzer discloses posting "business interface definitions" to describe the using self-defining, machine readable documents to be exchanged, the services offered, and using self-defining, machine readable documents to use for accessing such services (C2:45-67). Although Meltzer uses the term document, its use is limited to business documents companies use to "exchange information and services using self-defining, machine-readable documents, such as XML" (C2:48-50), a much narrower sense than the use of the term in Applicants' claims and specification (self-defining not being a limitation of Applicant's invention).

Meltzer does not use or mention any of semantic models, model mapping, or weighted candidate mappings (or their functional equivalents). At best, Meltzer refers to various document formats extended, for example, with "data structures that map predefined sets of storage units for a particular logic structure to respective entries in a list in order to provide a semantic definition of logical structures (e.g. mapping codes to product names)" (C3:18-23). These "semantic maps" are little more than data value translations and do not map concepts as in Applicant's model mappings.

Overview of Holt

Holt lies in the field of text mining, teaching a method of retrieving information from and classifying text documents. According to Holt, text documents are "any body of free or

semi-structured text" (Holt, C1:67-C2:3). Holt teaches a method of "semantic indexing" of terms found in text documents and using indexed terms to classify documents according to pre-defined classes (Holt, Abstract). A matrix of terms and documents (term-document matrix) is constructed to represent a collection of documents, the entries corresponding to relative occurrences of the term for that row in the document for that column. The term-document matrix treats the document collection mathematically as a multi-dimensional space, enabling various analyses and algorithms from that discipline. A query is likewise analyzed as if it were a document having terms and represented as a column of term occurrences (a single column term-document matrix). A score vector is constructed to predict the relative performance of documents in the document collection for the query. For classification, "the relationship of the document to the classes of documents is scored with the document" (Holt, Abstract).

Holt's invention requires term tokenization, score vectors, term-document matrix, and pre-defined classes, none of which is required or used by Applicants' invention. Holt's methods are limited to text documents, while Applicant's are not. Holt discloses none of semantic model, model mapping, or transformation as in Applicant's invention.

Overview of Pham

Pham lies in the field of data mining and, in particular, using a "unified neural multi-agent approach." Pham defines data mining as "an automatic pattern discovery process from complex databases to provide knowledge models for use in decision making" (C12:60-65). Pham discloses techniques for data mining within a database to create a predictive knowledge model (Abstract) for decision making by knowledge workers.

Pham teaches that knowledge representation techniques such as rules, semantic networks, and frames are in the prior art (C4:21-27) and discusses their limitations, but discloses nothing regarding the use of semantic models for the purpose of data transformation, data profiling, data normalization, data cleansing, and validation (either data or format, semantics or syntax). Applicant's specification already discloses semantic networks as

being in the prior art (para 0039) and provides prior art references that discuss rules, semantic networks, frames, and more (e.g., Sowa). Pham is concerned solely with the problem of augmenting a database so as to enhance decision making and does not disclose transforming documents between semantic models.

This purpose of Pham's invention (which includes enhancing decision making capabilities) is distinct from that of Applicant (data transformation, profiling, cleansing, normalization, etc.). Pham does not use any of semantic model, model mapping, or ontology, or any functionally equivalent term on which Applicant's invention depends.

Overview of Afeyan

Afeyan lies in the field of collective decision making and more particularly to developing new products and services using consumer research, market segmentation, design iteration, and market testing. With the exception of generating a new design, Afeyan does not describe the methods as computer implemented. The method requires a voting system.

Applicants' invention lies in a different field from Afeyan, and the purpose of Applicant's invention is radically different from that of Afeyan. It is not limited by the requirement of a voting system.

Overview of Altschuler

Altschuler lies in the field of user interfaces for finding semantic information and, in particular, representing, filtering, classifying, and linking semantic data in the context of information search and retrieval (Altschuler, Abstract and C1:9-16). Altschuler's invention depends on creating a "pattern lattice data space". Altschuler is not concerned with semantic models and transforming document between them. In fact, the only mention of "semantic modeling" is "[t]he pattern lattice data space is a theoretical construct that is a useful framework for semantic modeling..." (C16:42-51).

Altschuler and Applicant are concerned with different problems (i.e., finding semantic information and transforming documents according to semantic models, respectively). Applicants' invention does not pertain to "finding" semantic information, does not depend on "pattern lattice data space" and does not pertain to finding "semantic" information. Altschuler teaches nothing applicable in the context of Applicant's invention and claims, failing to disclose transforming documents using semantic models and model mappings or any use of semantic models beyond search and classification so as to enhance user interaction with computers. Applicants' use of semantic models is not limited to using a pattern lattice data space or any other technique disclosed by Altschuler.

Overview of Lin

Lin lies in the field of search and retrieval systems and, in particular, to concept-based search and retrieval of text documents indexed with ontology-based predicate structures. It "extracts the concepts behind a query" and "returns results matching that intent" (Abstract) using "concept-based searching" (C8:36-42). Documents are indexed by the predicates they contain (C20:20-25) and classified using a Bayes classifier (C10:17-35). Lin depends on a query ontological parser, classifier, sentence lexer, Bayes training and classifier algorithms, predicates, and a document clustering component.

Applicant's invention has a different purpose and lies in a different field from Lin (data transformation driven by semantic models versus concept-based search and retrieval of text documents). Applicant's invention depends on none of a query ontological parser, classifier, sentence lexer, Bayes training and classifier algorithms, predicates, or a document clustering component. Lin discloses none of semantic model, model mapping, or candidate model mappings on which Applicant's invention requires.

Overview of Cheng

Cheng lies in the field of bioinformatics and supplying genomic information to users over a network. Cheng teaches techniques for classifying and associating microarray genomic data. Genomic data is presented as an ontological map which is a visual representation of a genomic ontology as shown by Fig. 16A (1605) and discussed in, for example, paragraphs 0008 annd 0166. Cheng does not employ multiple semantic models or even multiple "ontological maps", let alone model mappings between semantic models.

Applicant and Cheng lie in diverse fields, sharing only disclosure of ontologies as prior art and possibly their graphical display. An ontological map in Cheng is clearly not a model mapping as in Applicant, since it pertains only to a single ontology (one kind of semantic model) and so cannot pertain to mapping between multiple semantic models. Nothing in Cheng is pertinent to Applicant's invention. Cheng's methods are limited to providing biological knowledge, and offer nothing pertinent to Applicant's subject matter including data integration, document (i.e., data) transformation, or model mapping.

Responses to Specific Claim Rejections

Applicant now proceeds to a detailed discussion of the claims rejections.

General Remarks Regarding Rejections Citing Only Georgalas

OA cites only Georgalas as prior art with respect to Claim 1, Dependent claims 6, 11, 12, 14, 16, 19, 20, 21, 22, 37, 38, 39, and 40, and Independent Claim 41, asserting that Georgalas teaches each of the steps of the respective claims. Applicants disagree. OA has misunderstood and misapplied Georgalas to Applicants' novel invention, at times reading Applicants' invention into Georgalas and proposing a strained interpretation with the benefit of hindsight. Georgalas solves a different problem (creating new resources in a common representation by combining existing resources in fixed, pre-specified

representations using a componentized architecture) than Applicant (data transformation, normalization, profiling, cleansing, and validation applied to source documents the semantics of which may be initially unknown or may change over time, maintaining the meaning of the source document and the validity of the resulting destination document). The problem Applicants address is a long-felt, long-existing but unsolved need, as the difficulty and cost of such exchange of documents among business entities is well-known (see, for example, Applicants' references and citations, especially Linthicum, Cummins, Omelayenko, Pollack, and Osterfelt). Finally, OA has not presented a convincing line of reasoning as to why the claimed subject matter as a whole, including its differences over the prior art, would have been obvious to one of ordinary skill in the art at the time the invention was made. Each of these reponses to the OA are further addressed below in response to the OA regarding specific claims.

Claim 1

OA erroneously equates "analyzing an object" by Georgalas (para 0084-0087) with "creating a first semantic model" by Applicant as in Claim 1. Analyzing an object in Georgalas is a manual process that results in one or more MOPClasses. It is not a step in a computer implemented method as is the step of creating a first semantic model disclosed by Applicant and Applicant's step is not constrained to result in a semantic model implemented as an object class (nor does Applicant believe a MOPClass would suffice). Georgalas states (para 0084) that "Objects are analyzed in [sic] their founding constituents, data and methods i.e. state and behaviour. In MOP, these primitive atoms are each modeled as a separate class. MOPClass is the premium semantics mechanism of MOP." While a MOPClass may be a semantics mechanism (i.e., a component for implementing semantics), state and behaviour encapsulated in an object are not semantic elements organized as a semantic model. It is one thing to implement a relationship or enforce a constraint among typed data, and quite another to represent knowledge of relationships, constraints, and metadata in an organized fashion. Georgalas does not disclose any method by which the semantics of an object can be organized, stored, modified, and interrogated, whereas much of Applicant's invention is devoted to this issue by virtue of transforming documents from one semantic model to another.

Furthermore, analyzing is not the same as creating.

OA's erroneously asserts that a category of knowledge as in Claim 1 is equivalent to a MOPClass. To the contrary, Georgalas suggests that a MOPClass, which is typed, implements a classification of objects, which are programmatic constructs (para 0083). Georgalas never uses the phrase "category of knowledge" or application domain (or their functional equivalents), and never suggests that analyzing an object creates a semantic model. Furthermore, if OA is asserting that a MOPClass is the same as a semantic model, then OA's assertion that a MOPClass is equivalent to Applicant's category of knowledge requires (in the light of the previous assertion) a MOPClass to be both a category of knowledge and a semantic model. Yet Applicant draws a clear distinction between a category of knowledge and a semantic model associated with it in both Applicant's claims and specification. Thus, these equivalences as asserted by OA cannot be correct: OA's assertions make indistinct that which is distinct and would make Applicant's required step of restricting a semantic model to representing a particular category of knowledge (as in Claim 1 and new Claim 42) meaningless.

OA erroneously asserts that storing a transformed representation of a resource (para 0068) constitutes storing a semantic model as in Claim 1. To the contrary, Georgalas makes it clear that what is stored is the representation of multiple resources in a common representation language (i.e., MOP). OA erroneously asserts that a model mapping is created (para 0090) and stored (para 0154). While Georgalas provides an example of a mapping between elements of two representations (ODMG to MOP), both of which are languages. Creating a model mapping is not disclosed by Georgalas as it is in Applicant's claims and specification (e.g., Applicant; para 0188-0220). Contrary to OA's assertion, the cited passage in Georgalas (para 0154) does not mention, let alone teach, storing a model mapping. Georgalas rule-based associations are not model mappings in that they do not provide a means to transform data between semantic models, but rather correlate data in distinct resources having multiple representations so as to create a new resource from the combination (para 0035, 0037). Thus the purpose and methods of Georgalas' invention differ from those of Applicant's invention.

OA erroneously asserts that Georgalas (para 0035) discloses accepting as input a first data the meaning of which is described by the first semantic model as in Claim 1. The cited passage merely describes receiving a *representation* of a resource, rather than data or even metadata (in that representation).

OA erroneously asserts that Georgalas (para 0035) discloses transforming first data according to the model mapping as in Claim 1. The cited passage, to the contrary, describes transforming *representations* of resources into a *common representation.* Indeed, this is an example of the value of MOP as a "model that describes models" as Georgalas explains (para 0089) as contrasted with Applicant's invention and computer implemented method for mapping models to models and using this to transform data compliant with those models.

OA erroneously asserts that Georgalas (para 0078) discloses validating first data according to a set of validation rules as in Claim 1. The cited passage, on the contrary, describes validating a *specification* using logical rules. A specification is not data the meaning of which is described by a semantic model. Nowhere does Georgalas suggest applying validation rules to such data.

OA erroneously asserts that Georgalas (para 0035) discloses forwarding (moving) transformed and validated data to a first software system as in Claim 1. The cited passage describes creating a new resource by virtue of the combination of two resource representations transformed into a common representation. As Georgalas does not describe transformed and validated data as in the earlier steps of Applicant's claim 1, it cannot describe moving such data to a software system.

Even if MOP were a semantic modeling method (Applicant does not agree that it is) in addition to being "a particularly suitable common representation" (para 0066), the methods claimed by Applicant cannot be read into Georgalas in hindsight. Georgalas nowhere suggests that MOP is anything other than a particular model for capturing

semantics of the language that describes multiple heterogeneous information resources and services. In order to transform data from one information resource into another information resource, MOP wrappers and mediators are required that first transform the data into an intermediate MOP representation (para 0067), a step not required by Applicant's invention.

Georgalas thus teaches a hub-based approach (i.e., resource-centered translation into a common resource representation – a many-to-one approach) while Applicant's method is not so limited, being able to perform both syntactic and semantic translation between a source documents associated with one semantic model and a destination document associated with a second semantic model (a many-to-many approach). There is no requirement in Applicant's invention that documents conforming to either a first or second semantic model be translated into a common representation (let alone that of MOP), and so no limitation to a semantic hub approach. The ability to handle a plethora of documents each possibly associated with a different semantic model is an implicit and unique strength of Applicant's invention.

With respect to the sub-step of creating a second semantic model in Applicant's Claim 1, OA erroneously asserts that "all one has to do is analyze another object to create a second semantic model and have a restrictive category of knowledge associated to it." The error of equating analyzing an object with creating a semantic model has been pointed out above. Even if that argument is ignored, nowhere does Georgalas suggest associating a restrictive category of knowledge (an entity which OA does not explicitly identify) with a MOPClass and OA provides no citation.

OA erroneously asserts halfway through Claim 1 a change in the proposed Georgalas equivalent of semantic model, requiring that the first and second semantic model of Applicant's claim are, "instead of 2 MOPClasses", now a State Class and Collections respectively. Not only is it erroneous to change asserted equivalences from step to step in reading a claim, but the OA thereby makes it impossible to read subsequent references to semantic model in Applicant's claim in the light of OA's conflicting assertions. Any

attempt to apply the supposed prior art per Applicant's claims is thus frustrated. OA further asserts that this limited interpretation in the context of a single step has the result required of that step "thereby creating a model mapping." However, the citation to Georgalas (para 0090:7-17) does not describe anything that can be construed as a mapping between two semantic models, nor does the subsequent citation to Georgalas (para 0154:5-8) mention a step of storing a mapping (or anything else). Even when Georgalas does describe an association, it is "between the common ones of the resources ***in their common representation*** to define a new resource", and not a mapping between semantic models that controls a semantic transformation between documents (as in Applicant's step of transforming said first data). Applicant's invention does not have as its goal the specific result of Georgalas and Georgalas does not accomplish the useful results of Applicant's invention.

OA erroneously asserts that Georgalas (para 0078) teaches the step of validating first data according to a set of validation rules as in Claim 1. However, Georgalas merely teaches that "when rule-based associations have been made, the logical rules defined by the [resource] specification will admit of a consistency validation in terms of inputs and output." Georgalas offers no further explanation and does not describe validation rules, but merely suggest the nature of a resource specification and its potential to validate consistenct use of that specification. By contrast, Applicant's validation rules are explicitly created to validate the data according to the source model, the applicability of the transformation to that source model, and the resulting data according to the destination model post transformation. Georgalas describes none of these.

OA erroneously asserts that Georgalas teaches [para 0035:11-13] forwarding transformed and validated data to a software system as in Claim 1. However, the cited passage does not describe forwarding transformed and validated data, let alone to a software system, because no data has been both transformed and validated in Georgalas.

Remarks Regarding Dependent Claims (Excepting Claim 41)

Each of Applicants' Claims 2-41 depend on Claim 1. Inasmuch as the OA rejection of Claim 1 has been overcome, the OA rejection of dependent claims is likewise overcome. Nonetheless, Applicant addresses the specific OA rejections of dependent claims below.

Were an attempt made to produce Applicant's invention using the components and methods of Georgalas, the result would not be functional. Numerous additional inventive steps and modifications would be required to correct the many deficiencies. For example, OA suggests no method (either in Georgalas or other prior art) for addressing the difficult problem of semantic drift. Georgalas' common resource representation, even if asserted to be a destination semantic model (and Applicant does not agree), is a representation that is completely fixed in advance and any transformation between representations is likewise unchanging. Errors (including representation deficiencies) that occur in combining resources according to such transformations are not addressable within Georgalas approach. By contrast, Applicant's invention provides an architecture and method for data transformation in which the semantic models associated with source and destination documents and the model mapping between them (which controls transformation) can be incrementally modified to correct for errors.

Responses to Rejections Involving a Combination of References

General Remarks

In responding to dependent Claims 7-10, 13, 15, 17, 18, and 21-40, OA combines Georgalas with various other references. Applicant objects to each of these combinations as impermissible for a number of reasons that are *prima facie* evident.

- The combinations are unsuggested. None of these references cites any of the others, nor do they contain any other suggestion (express or implied) that they be combined, let alone that they be combined in the manner suggested by the OA.
- Each of the suggested combinations would be impossible and non-obvious because of the diversity of problems addressed and great breadth of fields of

application (including, for example, common representation, natural language processing, collaborative design and market segmentation, document database search, information retrieval and document classification, genomic web portal, semantic search and rendering, and data mining).

- Even if any of the suggested combinations were possible, it would be necessary to make modifications (involving multiple inventive steps not taught in the prior art) to one or more of the methods of the cited references in order to combine the references in the manner suggested.
- Even if the necessary inventive modifications were made, the combination would lack the benefits of Applicants' invention discussed above, in part because the result achieved by Applicants' invention through synergy is greater than the results achieved by the individual references. The individual elements of Applicants' invention are defined and combined in a manner which achieves a synergistic result, for example, an architecture and methods that enable incremental and adaptive approach to data transformation, profiling, cleansing, validation, and normalization particularly suitable to business document exchange.
- That OA cites a large number of references in rejecting Applicant's Claims 13, 23, and 29-36 is itself evidence of their non-obviousness.

Each combination suggested by OA of a cited reference requires Georgalas. Reasons for disallowing specific combinations with Georgalas are discussed below. Should Examiner find these reasons insufficient or again cite such combinations as evidence of obviousness, Applicant is prepared to explain in great detail why the suggested combinations are not permissible.

Remarks Regarding Specific Combinations

In order to save the Examiner the effort of reading repeated arguments against each combination for each individual claim (which would extend to well over 100 pages of detailed response), arguments against pairwise combination of each cited reference over Georgalas are presented first, and referenced in the remarks on each new claim to explain

why the grounds for such objection have been resolved. Applicant denies all pairwise combinations support any such rejection but, due both to rewriting the claims for more clarity and for space reasons, has summarized his arguments as best he could.

Cha and Georgalas Cannot Be Combined

OA combines Cha and Georgalas with respect to dependent Claims 7-9, and 18. There is no reason to combine Georgalas and Cha, as neither references the other and the two address different subject matter. Georgalas addresses the field of distributed applications and the creation of new resources (as noted above) while Cha addresses the field of natural language processing and specifically information generation and retrieval using natural language query sentences (Cha, Abstract and Summary of the Invention C2:35-43). Georgalas and Cha are not even in the same US Patent Class. Cha does not discuss a referent semantic model as in Applicant's claims and specification, providing no functional basis for combination. Any proposed combination would necessarily require modifications and multiple inventive steps not disclosed in the prior art.

Georgalas and Meltzer Cannot Be Combined

OA combines Meltzer and Georgalas with respect to dependent Claims 10, 15, 17, 23, 24, and 28. There is no reason to combine Georgalas and Meltzer, as neither references the other and the two address different subject matter. Georgalas addresses the field of distributed applications and the creation of new resources (as noted above) while Meltzer addresses the field of systems and protocols supporting transactions among platforms having varied architectures, and specifically exchange of business documents and services (Meltzer, Abstract). Georgalas and Meltzer do not even share a US Patent Class. Meltzer does not discuss semantic models as in Applicant's claims and specification, nor resource representations or MOPClasses as in Georgalas, providing no functional basis for combination. As a result, any proposed combination would require numberous modifications and multiple inventive steps not disclosed in the prior art.

Georgalas and Holt Cannot Be Combined

OA combines Holt and Georgalas with respect to dependent Claims 13, 23, 29, 30, and 34. There is no reason to combine Georgalas and Holt, as neither references the other and the two address different subject matter. Georgalas addresses the field of distributed applications and the creation of new resources (as noted above) while Holt addresses the field of information retrieval from a text data collection and for classifying according to a plurality of predefined document classes (Holt, Abstract). Georgalas and Holt do not even share a US Patent Class. Holt does not mention semantic models, model mapping, or transformation as in Applicant's claims and specification, nor resource representations or MOPClasses as in Georgalas, providing no functional basis for combination. As a result, any proposed combination would require numberous modifications and multiple inventive steps not disclosed in the prior art.

Pham and Georgalas Cannot Be Combined

OA combines Pham and Georgalas with respect to dependent Claim 31. There is no reason to combine Georgalas and Pham, as neither references the other and the two address different subject matter and solve different problems. Georgalas addresses the field of distributed applications and the creation of new resources (as noted above) while Pham addresses the field of data mining to create a predictive knowledge model (Pham, Abstract). Georgalas and Pham do not even share a US Patent Class.

Pham does not discuss or use the terms semantic models, model mappings, or their functional equivalents as used in Applicant's claims and specification, or any of resource representations or MOPClasses as in Georgalas, providing no functional basis for combination. As a result, any proposed combination would require modifications not taught in the prior art.

Afeyan and Georgalas Cannot Be Combined

OA combines Afeyan and Georgalas with respect to dependent Claim 23 and 36. There is no reason to combine Georgalas and Afeyan, as neither references the other and the two address different subject matter. Georgalas addresses the field of distributed applications

and the creation of new resources (as noted above) while Afeyan addresses the field of collective decision making and more particularly to developing new products and services using consumer research, market segmentation, design iteration, and market testing (Afeyan, Abstract). Georgalas and Afeyan do not even share a US Patent Class. Afeyan does not discuss semantics or semantic models (or their functional equivalents) as in Applicant's claims and specification, nor resource representations or MOPClasses as in Georgalas, providing no functional basis for combination. As a result, any proposed combination would require numberous modifications and multiple inventive steps not disclosed in the prior art.

Altschuler and Georgalas Cannot Be Combined

OA combines Altschuler and Georgalas with respect to dependent Claim 23. There is no reason to combine Georgalas and Altschuler, as neither references the other and the two address different subject matter and solve different problems. Georgalas addresses the field of distributed applications and the creation of new resources (as noted above) while Altschuler addresses the field of user interfaces and, in particular, representing, filtering, classifying, and linking semantic data (Altschuler, Abstract). Georgalas and Altschuler do not even share a US Patent Class. Altschuler does not discuss any of semantic models, model mappings, or their functional equivalents as in Applicant's claims and specification, or any of resource representations or MOPClasses as in Georgalas, providing no functional basis for combination. As a result, any proposed combination would require modifications not taught in the prior art.

Lin and Georgalas Cannot Be Combined

OA combines Lin and Georgalas with respect to dependent Claims 32 and 33. There is no reason to combine Georgalas and Lin, as neither references the other and the two address different subject matter and solve different problems. Georgalas addresses the field of distributed applications and the creation of new resources (as noted above) while Lin addresses the field of search and retrieval systems and, in particular, to concept-based search and retrieval of documents indexed with ontology-based predicate structures (Lin, Abstract). Georgalas and Lin do not even share a US Patent Class. Lin teaches using

semantic representation techniques such as semantic networks (which Applicant discloses in para 0039-44 as bing in the prior art) and "ontology-based predicate structures" (Abstract), but discloses nothing regarding the use of semantic models for the purpose of data transformation. Lin does not disclose transforming documents between semantic models, but is concerned solely with the problem of document database search techniques using concept-based indexing. Lin does not discuss or use the terms semantic models, model mappings, or their functional equivalents as used in Applicant's claims and specification, or transformation of any resource representations or MOPClasses as in Georgalas. Likewise, neither applicant nor Georgalas are concerned with document search or concept-based indexing. Thus, Lin and Georgalas provide no functional basis for combination. As a result, any proposed combination would require modifications and inventive steps not taught in the prior art.

Cheng and Georgalas Cannot Be Combined

OA combines Cheng and Georgalas with respect to dependent Claims 32 and 33. There is no reason to combine Georgalas and Cheng, as neither references the other and the two address different subject matter and solve different problems. Georgalas addresses the field of distributed applications and the creation of new resources (as noted above) while Cheng addresses the field of bioinformatics and supplying genomic information to users over a network (Cheng, Abstract). Georgalas and Cheng do not even share a US Patent Class. Cheng teaches using "ontological maps" (i.e., an ontology used to "map" data) as representation of genomic data (a use of ontologies disclosed by Applicant in para 0032) and providing "probe-set identifier association data" (Abstract), but discloses nothing regarding the use of semantic models for the purpose of data transformation. Cheng does not disclose transforming documents between semantic models, but is concerned solely with the problem of document database search techniques using concept-based indexing and classifying and associating genomic data. Cheng does not discuss or use the terms semantic models, model mappings, or their functional equivalents as used in Applicant's claims and specification, or transformation of any resource representations or MOPClasses as in Georgalas. Likewise, neither applicant nor Georgalas are concerned with concept-based indexing. Thus, Cheng and Georgalas provide no functional basis for

combination. As a result, any proposed combination would require numberous modifications and multiple inventive steps not disclosed in the prior art.

Additional Remarks on Combinations with Georgalas
(Dependent Claims 7-10, 13, 15, 17, 18, 23, 24, 28-36)

- In light of the novelty of new Claim 42 and on which new Claims 44, 46, 49, 51, 52, 65, 68, 80, 81, 82, 83, 85, 88, 89, 90, 91, depend, Applicant's dependent claims are entirely foreign to each of the cited references.
- *No suggested combination*. None of the cited references mention the other.
- *Each reference is individually complete in itself.*
- *The other references take mutually exclusive paths from Georgalas*: None of the other cited references teach a method of creating new resources in a distributed computing environment as in Georgalas.
- *These references teach away from each other*: The references are incompatible in that none teach any method compatible with those of Georgalas and are not even in the same fields.
- *The references cannot be combined:* Georgalas does not address the problems addressed by the other references, and none of the other references depends on the elements/or methods of Georgalas. Hence, there is no functional basis for combining any of the references with Georgalas.
- *Any combination would be inoperable*: Neither Georgalas nor any of the other references address or enable data transformation driven by semantic models, either individually or in combination.
- *Modifications are not taught in the prior art would be required to effect a combination*: In particular, somehow Georgalas would have to be converted into a system for data transformation driven by semantic models of the source and of the destination, which is not taught in the cited prior art and which Georgalas teaches against (Georgalas depends on a common resource representation and is a mediator system).
- *Even if combined, the references would not meet the claims since claims features would be lacking,* including adaptive data transformation, data profiling, data